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# **USDA-CSREES Stakeholder Priorities Workshop**

## **for Animal**

### **Agriculture, Nutrition, and Food Safety**

## **Statements from Stakeholders**

### **Promote Animal Well-Being**

American Society of Animal Science

### **Protect Animal Health**

Animal Agriculture Coalition

American Veterinary Medical Association and the Association of American Veterinary Medical Colleges

Catfish Farmers of America

### **Improve Food Safety and Public Health**

American Society of Animal Science

American Veterinary Medical Association and the Association of American Veterinary Medical Colleges

USDA-Food Safety Inspection Service

### **Enhance Human Nutrition**

American Society of Animal Science

American Society for Nutritional Sciences

Society for Nutrition Education

University of California, Davis

### **Strengthen Global Competitiveness**

American Veterinary Medical Association and the Association of American Veterinary Medical Colleges

### **Ensure Environmental Quality**

American Society of Animal Science

Catfish Farmers of America

Moderator's Summary

## **Summaries of Sessions**

Promote Animal Well-Being

Protect Animal Health

Enhance Human Nutrition

Strengthen Global Competitiveness

Ensure Environmental Quality

## **Statements from Stakeholders**

### **Promote Animal Well-Being**

#### **American Society of Animal Science**

**GOAL:** Promote Animal Well-Being - Jeffrey D. Armstrong, ASAS

Animal agriculture and allied industries, supporting science and technology, and society's view of animal agriculture are undergoing dramatic change. More and more groups and individuals are questioning how our food is produced. This is exacerbated by the fact that a very small percentage of the population is directly involved in animal agriculture.

The animal industry has long been concerned with animal welfare. Good producers have long equated animal well-being with enhanced productivity, absence of disease and thus higher profits. Production gains through confinement have resulted in an increased number of situations where the economics of animal production clash with animal welfare. We must be on a constant vigilant to identify and change situations where animal welfare and animal production systems are incompatible. This will require solid research to promote animal well-being. Moreover, animal well-being will become a critical factor in productivity, food safety, international trade and regulatory discussions and, indeed, the continued social acceptance of animal agriculture.

A major research need is to develop better scientific measures to assess animal well-being. This requires both physiological and psychological approaches. Physiological assessment generally includes the absence of disease and injury. Psychological assessment is more difficult to ascertain but is generally thought to include good health, exhibition of species-typical behavior, freedom from distress, and demonstrated ability to adapt and cope with the environment. At this juncture, it is important to mention the importance of partnerships. USDA-ARS recently held a program review and has an excellent summary of this area. (See: [www.nps.ars.usda.gov/programs/105s2.htm](http://www.nps.ars.usda.gov/programs/105s2.htm))

A second research priority is to determine impact of current and alternative production systems on animal well-being and food quality. This includes adaptation and adaptedness, social behavior and spacing, cognition and motivation, and evaluation of practices and systems to improve well-being. Generally, three approaches have been used to improve well-being in confinement systems. These are environmental manipulation, therapeutics (physical and physiological), and genetic manipulation. Typically, the latter has been limited to traditional animal breeding practices; however, in the future, this will likely include genetically modified organisms. A systemic approach to understand animal well-being is critical not just because of the underlying complexity of the biological systems, but because of the linkages to food quality, food safety and in the future to biotechnology or genetically modified animals.

Third, it is critical that we explore social and political issues in animal production and research. The aesthetic component of animal production systems, the underlying basic understanding of biology and the tendency for anthropomorphism are major reasons for the inclusion of social research priorities. Social research priorities should include a definition of the issue, education of consumers, policy makers and students, and evaluation of policy and production alternatives.

In summary, an integrated, multidisciplinary approach to research and education programs in animal well-being will provide tools for the proper assessment of well-being. Moreover, we will have a better understanding of the impact of practices and systems on welfare and the interaction with food quality and safety. Ultimately, this will allow producers to continue to refine guidelines and thus provide full disclosure (to the public) of how their food is produced. Finally, it is likely more important for this area than any other that education and research programs move along in tandem. First and foremost, the importance of this issue should be stressed to those in positions of establishing research priorities, especially funding. The most immediate need is additional scientists to bolster existing teams / programs.

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## Protect Animal Health

### Animal Agriculture Coalition

Represented by

Bernadette Dunham, D.V.M., Ph.D.

Diseases of Economic Importance to the \$100 billion U.S. Agriculture industry

#### Key Species Groups Involved:

- Swine
- Bovine
- Poultry/Turkey
- Ovine
- Equine
- Aquaculture

#### SWINE

- Foreign Animal Diseases
- Classical Swine Fever (Hog Cholera)
- Foot-and-Mouth Disease
- African Swine Fever

#### SWINE

##### Domestic Health Issues

- Porcine Respiratory Disease Complex
- Porcine Reproductive Respiratory Syndrome (PRRS);
  - Mycoplasma; Influenza; *Pasteurella*
- Breeding Herd Syndrome
  - PRRS; Influenza H3N2; *Erysipelas*
- Enteric Disease Syndrome
- Post-weaning *E.coli*; *Salmonella*; Gastric ulcers; Ileitis; Colitis

#### SWINE

##### Emerging Diseases

- Nipah Virus
- Post-weaning multi-systemic wasting syndrome
- Porcine dermatitis and nephropathy syndrome
- Hepatitis E virus

#### BOVINE - Dairy Cattle

- Mastitis
- Salmonellosis
- Paratuberculosis (Johnes Disease)
- Bovine Viral Diarrhea

## Papillomatous Digital Dermatitis

### BOVINE - Beef Cattle

- Bovine Respiratory Disease
- Bovine Respiratory Syncytial Virus (BRSV)
- Bovine Viral Diarrhea Virus (BVD)
- Foot-and-Mouth Disease

### POULTRY

- Tumor Related Diseases
  - Marek's Disease
  - Myeloid Leukosis
  - Avian Leukosis Virus Subgroup J
- Respiratory Diseases
  - Infectious bronchitis virus (IBV)
  - Infectious Laryngotracheitis (ILT)

### POULTRY

- Immune Suppressive Diseases
  - Chick Anemia Virus (CAV)
- Parasites
  - Coccidiosis (*Eimeria sp.*)

### TURKEY

- Avian Pneumovirus
- Poult Enteritis Mortality Syndrome (PEMS)

### OVINE

- Scrapie
- Ovine Progressive Pneumonia (OPP)
- Paratuberculosis (Johnes Disease)

### OVINE

- Additional diseases of economic impact
  - Gastrointestinal Parasites
  - Interdigital Dermatitis
  - Respiratory Diseases

### EQUINE

- Equine Morbillivirus Pneumonia
- Equine Infectious Anemia (EIA)
- Equine Viral Arteritis (EVA)
- Contagious Equine Metritis (CEM)
- Vesicular Stomatitis Virus (VSV)
- West Nile Fever

## EQUINE

Additional diseases of economic importance:

- Equine Influenza Virus
- Rhodococcus equi* - foals
- Colic
- Laminitis
- Rotavirus

## AQUACULTURE

- Enteric Septicemia/Columnaris infection
- Winter Kill
- Proliferative Gill Disease
- Taura Syndrome Virus

## General Issues of Concern to the Animal Agriculture Coalition

- Food safety
- New & Re-emerging Infectious Diseases
- Antimicrobial Resistance
- Biological Terrorism

## American Veterinary Medical Association and the Association of American Veterinary Medical Colleges

Good afternoon, my name is Dr. Christopher Chase, I am an Associate Professor at South Dakota State University's Department of Veterinary Sciences. I am also a member of the American Veterinary Medical Association's (AVMA) Council on Research. This afternoon I am here representing the Association of American Veterinary Medical Colleges (AAVMC) and AVMA.

The AAVMC coordinates the affairs of the 27 U.S. veterinary medical colleges, the four Canadian colleges of veterinary medicine, departments of veterinary science and comparative medicine and the animal medical centers. In addition, the Association fosters the membership's teaching, research and service missions both nationally and internationally. The principal goal of the AAVMC is improving the quality of life for both humans and animals. The AAVMC realizes this goal by addressing the needs of both consumers and the producers of food and fiber, as well as the needs of all animal owners.

The AVMA is the national professional association of veterinarians whose 63,000 members are charged ethically and legally with the protection of the health of animals within their care, as well as the protection of public health.

\* Both AAVMC and AVMA agree with and support the previous statements made by Dr. Dunham for the Animal Agriculture Coalition (AAC). These diseases represent priority areas to the animal agriculture industry. With limited dollars, the notion of funding "good science" for animal diseases that have good control programs or are no longer of economic impact is questionable. This AAC list should

be used for the National Research Initiative review panels when considering infectious disease funding. Good science aimed at an emerging disease on the AAC list is a better investment than great science on a disease of limited economic importance.

- \* For each new agent or disease outbreak, it is essential to develop an understanding of the agent and disease in order to devise a means of diagnosis and control. This is accomplished through both laboratory- based and epidemiological investigations/surveillance programs.

- \* Successful study of infectious animal disease is determined by many factors

  - Pre-existing technical and scientific experts on the disease process

  - Adequate funding

  - Availability of suitable facilities

- \* Genomics is the area of research that seeks to understand the gene and its function. There is a need for a concerted national program that increases research efforts.

- \* Understanding the function of animal and microbial genes will allow for improvements in animal health.

- \* Microbial genomics research holds the promise of providing new insight into microbial pathogenesis, evolution, diagnostics, vaccines and therapeutics. This research will yield valuable information for molecular epidemiological analysis of disease outbreaks, for identification of virulence and host range factors, and for development of new diagnostic and control approaches.

- \* Science and research are still needed:

- 1) More genetic maps of the genomes of livestock and microbial species

- 2) Genetic sequences of livestock and microbial species

- 3) Further knowledge of gene function

- 4) Development of libraries of genetic data or bioinformatics

- 5) Knowledge of gene modification for new animals and animal vaccines.

- \* Research using naturally occurring nutraceuticals such as conjugated linoleic acid (CLA) from flax and fish oil and isoflavones from soybeans as anti-microbial agents could lessen the use of antibiotics and provide additional value added opportunities for feed commodities.

- \* There is still a need for continued development of a comprehensive, integrated disease surveillance system.

- \* Continued basic research for improved, rapid, reliable diagnostic techniques is essential.

- \* Finally an accumulation of data to complete quantitative risk assessments of the relationship between the use of antibiotics in animals and the human health risks and/or benefits is necessary before any "science" based decision can be made on the feedgrade antibiotic issue.

## CATFISH FARMERS OF AMERICA

Catfish Farmers of America, (CFA) is the trade association that represents the interests of the farm-raised catfish industry. Founded in 1968 and with membership from thirty-one states; CFA is recognized as the nations strongest aquaculture association. Catfish farming is the dominant component of U.S. aquaculture - representing 72% of the total production volume and 55% of the product value.

Aquaculture is poised to become a major growth industry in the 21st century. The U.S. imports nearly half of the its fisheries supplies. This results in a fisheries trade deficit of \$4 to \$7 billion



annually, the largest trade deficit for any food or agricultural commodity.

USDA Should Expand its Integrated Aquaculture Research and Extension Programs in Three Critical Areas including: Aquaculture genetics, health management and environmental sustainability of aquaculture systems.

1. There has been only limited genetic improvement of aquaculture stocks so there are major opportunities in traditional animal breeding and in genetics to improve the growth, efficiency, health status, and product form and quality of commercially valuable aquaculture species. Genetic improvement of aquaculture stocks will require enhanced efforts in research related to selective breeding; genome mapping; and identification and genetic enhancement of economically important traits.
2. Losses to diseases constitute one of the major economic impacts of U.S. aquaculture today. Over 65 diseases affect cultivated U.S. aquaculture species, and devastating emerging diseases of catfish, salmonids, marine shrimp and other species threaten the future of the industry. The industry's ability to control diseases is severely constrained by inadequate knowledge of many diseases and limited prevention or treatment options, including vaccines, therapeutics, and management techniques. Improved management of aquatic animal health will require expanded efforts in understanding pathogens and mechanisms of disease transmission; improved technologies to detect pathogens before disease outbreaks occur; and development and approval of new vaccines and animal drugs to prevent and treat diseases.
3. There is increasing concern about the potential impact of agriculture on the nation's water quality and the possible contribution of agriculture-based nutrients to harmful algal blooms. As U.S. aquaculture continues to expand it must be sustainable and environmentally compatible, particularly with regard to protection and conservation of the nation's water resources. There is significant need for expanded efforts to improve efficiency in the utilization and management of surface and ground water supplies in aquaculture systems; to develop more efficient and cost-effective waste management processes and technologies in aquaculture; and to develop economically viable users of aquaculture production and processing byproducts.

## Improve Food Safety and Public Health

### American Society of Animal Science

Comments by Don Beermann, President American Society of Animal Science

Until very recently the focus of food safety issues involving animal-derived food products has been on processing and(or) manufacturing methods and the processing environment. HACCP plans were mandated for meat and poultry slaughter and processing enterprises to help identify critical control points and approaches which can impact and ensure food safety. There are areas where additional post-harvest research is needed, but there is recent evidence of growing concern and need for research in the pre-harvest arena, particularly with regard to the prevalence of *E. coli* O157:H7 in fed cattle.

Post-harvest areas which need investigation include validation of “safe process” for specific products, especially those manufactured by small or very small processors who don’t have the resources to conduct validation research. A second area of concern is *Listeria monocytogenese* presence in cooked processed products. This pathogen is usually introduced to meat and dairy products through post-heat treatment contamination, making it difficult to develop effective HACCP approach(es) for this pathogen.

Many analysts have identified cattle as the main reservoir and source of *E. coli* O157:H7 and they contend that pre-harvest intervention(s) should enhance the efforts of the slaughtering and processing industry in preventing contamination of meat by this pathogen. Recent data from studies conducted at the USDA Meat Animal Research Center and by investigators at the University of Nebraska, Lincoln indicate that prevalence of the pathogen is much greater than initial data indicated. Increased sensitivity of test used to enumerate the pathogen were used by both groups in studies involving cattle in research facilities and in privately-owned Midwestern feedyards is in agreement. *E. coli* O157:H7 was recovered from at least two animals in each of 29 pens in five private feedyards and from at least one animal in 11 of 12 research pens in studies conducted at the University of Nebraska. The pen prevalence varied significantly from .7% to 80% in the commercial feedyards. These data indicate that *E. coli* can be commonly present throughout various feedlot systems and that most pens will have at least a few cattle shedding the organism in the feces. We do not understand the factors that influence or explain the distribution of the bacteria.

More research is needed to identify pre-harvest factors that influence prevalence in fed cattle, to determine whether positive relationships exist between presence in live cattle and carcasses derived from them, and to determine whether pen tests are accurate in identification of cattle shedding the organism. Other aspects of processing that could influence likelihood of carcass contamination in the slaughter and processing plants also need investigation.

The goals of this research are to provide information that can be used to reduce prevalence of *E. coli* O157:H7, salmonella and other food-borne pathogens, to increase accuracy and ease of detection of these pathogens, and to conduct risk-benefit analysis of changes in management practices in beef production and processing systems. Increased assurance of food safety and improved sustainability of beef production systems are anticipated outcomes.

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Food safety is an issue of paramount importance, not because it is currently a popular political topic, but because it affects each and every person in this room and in this nation. In terms of food safety, everyone is a stakeholder, the grower, the producer, the packer and finally the consumer. While in many cases food safety concerns are traced to improper handling by the consumer, we can and should do more to assist farmers and ranchers produce food that minimizes food borne illness at the consumer level. We need to develop a body of knowledge from applied on-farm research that will prepare producers, extension specialists, and veterinarians to be better "applied practitioners" of food safety for on-farm interventions. These on-farm interventions are important to all stakeholders and especially to veterinarians, extension specialists, and the producer themselves.

The increasing realization that biological systems are ultimately linked in some form or fashion, makes it timely to approach food safety problems in a multi-disciplinary manner. The causes of and the methods to control food borne illness have become perspicuous examples of this fact. The agricultural industry is going to increasingly be asked to step up and shoulder responsibility for the food safety aspects of public health.

Therefore a national commitment dedicated to the continual goal of identification, control, and elimination of food borne illness is needed for those involved in production agriculture.

Research efforts into the ecosystem of infectious agents, such as Salmonella and E. coli O157- H7, that pose a serious hazard to human health via contamination of food stocks, must continue. In addition, improvement of on-farm and environmental knowledge of these known pathogens and understanding the methodologies to control these food borne pathogens will become increasingly important to protect U.S. export markets. Gaining an improved understanding of microbial ecology as it relates to the contamination of food supplies combined with the information derived from a newly focused animal health to healthy human research effort, will

provide a foundation of knowledge to support new training programs, both at the professional and graduate levels. The fundamental knowledge as well as the programs creating experts in food safety intervention methodologies are in high demand and sorely needed for U.S. agriculture.

Research efforts with disease agents such as Johne's Disease and Chronic Wasting Disease whose public health impact is unclear must be done to protect the animal agriculture industry from potential devastation like that seen with the British cattle industry and bovine spongiform encephalopathy (BSE). Although these animal diseases have not been linked by any scientific research to human disease, the perception that they could be linked to chronic insidious human diseases could be catastrophic for the food animal agriculture industry. Johne's Disease in cattle and its possible link to Crohn's disease in man could endanger the entire dairy industry and the occurrence of Chronic Wasting Disease in farm reared elk and the "possible" cross species transmission to cattle could raise the BSE issue in the US. Fundamental research on the occurrence of Johne's Disease in food products and the basic CWD diagnostic and control measures are priority areas.

On-farm pre-harvest food safety systems for each of the six major animal product commodities, including aquaculture, eggs, poultry, dairy, beef, and swine are needed.. Collaborative studies need to be carried out with a variety of experts and disciplines studying on-farm systems to develop strategies for understanding the ecology of pathogens and avoiding contamination of animals and animal products before they leave the farm gate. Information gained in the study of microbial ecology will assist in the development of procedures that result in risk identification and assessment, and risk management of pathogens in each commodity area. This type of collaborative research that encompasses multi-disciplinary approaches to problem solving is increasingly necessary. It is important to realize the problem solving capabilities that can be derived from integrative biology approaches.

We must also protect our domestic food supply and prevent non-tariff trade barriers to our export markets by using knowledge generated by research on foreign animal diseases and new and reemerging diseases. Considering the global economy and increasing recognition that foreign animal diseases may not be so foreign, it is paramount that we ready ourselves for challenges that may threaten entire domestic animal agricultural sectors, whether they be a real epidemiological problem or just politically based. One of the best ways to prepare ourselves for issues of a sanitary or phytosanitary nature, whether they be import or export, is via knowledge. This nation's research mission can and should advance this knowledge. An increased awareness represented by specific funding of research into foreign animal disease, as well as those diseases that qualify as new and reemerging, is fundamental in order to protect markets and maintain a favorable balance of trade for this nation's agriculture. My medical colleagues that work only on one species, the physicians, have recognized for years there is no such thing as exotic or foreign disease in human medicine. All human ailments fall on to a single list with various levels of concern attached to them because anyone of those ailments can end up in the middle of this country with one airplane ride. This is becoming the case for our animal agriculturists. Remember, the days of our animal agriculture isolation are quickly disappearing. Therefore research funding directed toward understanding and preparation for new and emerging animal disease threats is not only warranted, it is a proper use of public funds.

Finally, we must determine the food safety impact of various animal production management strategies so that sustainable practices with the lowest possible risk to consumers will be widely used. Research is needed that fairly evaluates various production techniques for effects on human health, such as animal feeding of low level antimicrobial agents and the development of antimicrobial resistance. Genomic studies that would enable rapid identification of microbes through molecular fingerprinting should also be included. Development of molecular fingerprinting strategies for microbe identification would be an essential element to management systems for livestock, and natural resources and the environment. This type of knowledge is paramount if pathogenic organisms, including *Salmonella* and *E. coli* O157-H7, are to be controlled or even eliminated in the human food supply.

In conclusion, I would like to once again thank you for allowing us this opportunity to discuss stakeholder issues in this forum. I hope that our comments will be helpful to you.

## USDA-Food Safety Inspection Service

F. Erich Hemphill, DVM, Ph.D. Representing USDA-Food Safety Inspection Service.

Very happy to participate and represent the USDA-FSIS at this very important workshop sponsored by the CSREES. I have no prepared speech, but will share with you some very pertinent remarks and thoughts about food safety research priorities and challenges on behalf of the Food Safety and Inspection Service, the regulatory agency responsible for the safety of meat, poultry, and egg products.

For food safety in FSIS, two driving forces are at the core of both our regulatory and research agendas. The first driving force is our goal of protecting the health of the public. In the United States, recent estimates are that foodborne microbial pathogens account for approximately 76 million illnesses, 325, 000 hospitalizations, and 5,000 deaths each year. Three pathogens-*Salmonella*, *Listeria* and *Toxoplasma*, are responsible for 1,500 deaths each year-more than 75 percent of those caused by known pathogens.

These data represent a baseline against which we can measure future efforts to improve food safety and they support what we have known all along, that the burden of foodborne illness is substantial.

We have an important goal of reducing these numbers to the fullest extent possible. To help achieve this goal, the Clinton Administration reorientated the mission of the Food Safety Inspection Service to focus more on public health and to work to improve the scientific base needed to make good regulatory decisions that are based on public health.

Evidence of this improved public health focus include: 1) implementation of the rule on Pathogen Reduction and Hazard Analysis and Critical Control Point (HACCP) systems, 2) development by FSIS of a public health driven food safety research agenda, 3) involvement with CDC in the Food Net foodborne disease active surveillance system, 4) the completion of the first quantitative microbial risk assessment on *Salmonella enteritidis* in eggs and egg products; and (5) development of a farm-to-table process risk model for *E. coli* O157:H7 (nearing completion).

The second driving force is our farm-to-table strategy which addresses the entire farm-to-table chain, not just federally inspected establishments. In order to achieve the goal of reducing foodborne pathogens through this farm-to-table strategy, a wide spectrum of research-based interventions and technologies will be needed that can be implemented on farms and ranches, in feed lots, in food processing plants, in distribution, at retail stores, and in commercial kitchens and in homes. Research priorities directly related to pathogen reduction and food safety are to develop improved detection methods, develop new prevention and intervention strategies, and study resistance to traditional preservation techniques and to antibiotics.

Because FSIS is not a research agency, it must reach out to other research agencies to meet its research needs. CSREES and ARS are greatly appreciated.

Research Priorities. In May 1997, FSIS published its Food Safety Research Agenda as one means of communicating with those outside the Agency about its priorities in food safety research. This agency is the best articulation of our research needs in support of our top regulatory priority which is the implementation of HACCP systems in meat and poultry slaughter and processing plants. The agency identifies a short list of pathogens of primary concern to the agency: enterohemorrhagic *E. coli*, particularly *E. coli* 0157:H7, *Salmonella*, *Campylobacter*, and *Listeria*. The agenda also poses a set of general questions and for each of the high priority pathogens some very specific questions. All of these research questions relate directly to either real time regulatory decisions that the agency faces on a daily basis, or to longer term policy development to further enhance public health protection. Although this agenda was first published in 1997, most of the questions remain unanswered and are therefore included for potential discussion during this workshop:

What is the relationship between the numbers of bacteria on raw products and foodborne illness?

What are the risks along the food chain?

How are pathogens introduced into the food chain?

Is it possible to predict emerging foodborne pathogens?

Are there vaccines or other production level interventions that would eliminate or reduce pathogens in raw products?

Finally, a research priority of paramount importance is to better understand the various aspects of antimicrobial resistance e.g., mechanisms of resistance development and mechanisms of resistance transfer.

We also need information on the means by which antimicrobial drug use can be decreased in food animals, such as, improved animal husbandry practices, competitive exclusion products, etc.

## **Enhance Human Nutrition**

### **American Society of Animal Science**

Represented by Robert G. Zimbelman, Ph.D.

#### **Researchable Hypotheses:**

- 1) Does the glycemic index of foods impact weight gain?
- 2) Does adherence to Dietary Guidelines Pyramid reduce level of obesity?
- 3) Are all fats of equal value to health and weight gain, especially are natural trans-fats in animal products of different impact than those from hydrogenation of oils?

#### **Rationale for researchable topics:**

The US has had a campaign for a dozen or more years implicating a low-fat approach to reducing the incidence of obesity and related health problems. During that time, the incidence of obesity has increased. Some persons could conclude that the low-fat campaign has failed because the basic assumption is incorrect. While true that each gram of fat contains more calories than carbohydrates or proteins, perhaps people eat to a level of fat intake and to reach that level with low-fat products, they consume more calories from other sources. There also is some evidence that fat, protein, and carbohydrates cause differing physiological and hormonal impacts on the metabolic system. The glycemic index of foods predicts their ability to raise insulin levels, proposed by some as the major factor in increasing deposition of fat.

A simplistic message regarding obesity has been that red meats and other animal products were the main problem. During the last half-century, obesity has been on the increase. During that time, beef consumption has decreased slightly, while consumption of butter and other animal fats has decreased markedly, but consumption of sugar and carbohydrates easily converted to sugar has increased markedly. See the recent CAST report on consumption figures for confirmation. In recent times, the most popular non-fiction books have been those promoting high protein and restricted sugar consumption. The public apparently also feels that low-fat diets are not helping them achieve their goals.

Behind the concept of glycemic index of foods is the idea that all grains are not equal, neither are all fruits or vegetables the same in their impact on the body's metabolic system. So if one followed the Dietary Pyramid with grains or fruits and vegetables that have a high glycemic index, they might very well gain more weight while they believe they are doing the correct thing. Also, many low-fat foods have been made more palatable by adding sweetness to replace the normal satiety and palatability effects of fats.

Recent FDA proposals to label foods for their content of Trans-fatty acids (TFA's) is apparently based on the marked increase in such TFA's through consumption of margarine as an alternative to butter, and some evidence that such fats increase serum cholesterol levels. At the same time, much research has discovered beneficial effects of one or more natural TFA's, namely conjugated linolenic acid (CLA). Anti-carcinogenic effects, in particular, have been described. Research should be done to establish whether the content of TFA's is a desirable or undesirable aspect of food. If some

TFA's are desirable and others undesirable, then some other labeling strategy would seem justified.

## American Society for Nutritional Sciences

The American Society for Nutritional Sciences (ASNS) appreciates this opportunity to provide comments regarding the research priorities for the NRI Program in Improving Human Nutrition for Optimal Health.

ASNS, in collaboration with the USDA Food Safety Inspection Service, held a one-day workshop focusing on Food Borne Illness and Nutrition on December 3, 1999. Participants at the workshop strongly endorsed the need for more research in this area. The potential for nutrition to influence the response of the human host to food borne disease is poorly understood. Both basic and clinical investigations are needed to elucidate the role of nutrients or other food components in reducing the risk of food borne infections. At the population level, clinical trials investigating the effect of specific nutrients on susceptibility to food borne infections are needed along with research that identifies markers of nutritional and immune status that are associated with risk for infections. At the functional level, studies are needed which foster and extend the understanding of food components on gut-mediated immunity. Other areas that have potential for further study include the interaction between diet, age, and genetic factors on susceptibility to foodborne illness and the long-term effects of infection on development and immune function in children and the elderly. Of prime importance is the development of new biomarkers of risk for food borne infection and effective dietary strategies for reducing or preventing the complications associated with the illness.

ASNS also recommends that consideration be given to the health benefits of plant foods in diets. This would include identifying components of plant foods that reduce the risk of chronic diseases, investigating how various phenotypes/genotypes respond to different intakes of those food components, bio-engineering plant foods to provide increased levels of nutrients or other components that are important to health, and testing the efficacy of those modifications in animals and humans.

ASNS was unable to make a statement at the CSREES Stakeholders meeting last week on animal production and human nutrition. However, we believe that the potential impact of altered or 'functional' animal food products on human nutrition has received too little attention. Examples of research which should be promoted in that area include the impact of modification of fatty acid profiles in milk or meat or cholesterol reduction in eggs on risk factors for chronic disease. Also, in conjunction with our above statement about food borne illness, research on probiotics from animal products, i.e. lactoferrin, on gut-mediated immunity and resistance to infection needs further study. Further work on identifying the foods most involved in food borne illnesses and characterizing new foodborne pathogens carried by animal food products is also needed.

ASNS appreciates this opportunity to contribute comments regarding the NRICGP's research program in human nutrition and food safety. The priorities outlined above represent a common voice of the 3000 members of ASNS who are involved in human as well as animal nutrition research.



## Society for Nutrition Education

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The Society for Nutrition Education (SNE) welcomes this opportunity to provide testimony on the Cooperative State Research, Education and Extension Service's (CSREES) Priorities for Animal Agriculture, Nutrition and Food Safety.

SNE is an international organization of professionals actively involved in the education of consumers about food, nutrition and health. Our members are involved in range of activities. These include research in education and communication, development of innovative education strategies, and communicating information on important issues related to food, nutrition and health. SNE members are employed in a variety of institutions and programs, including public health agencies, colleges and university campuses, government agencies, cooperative extension, schools, communications groups, public relations firms, the food industry, and voluntary health and service organizations.

While all of the professional societies and organizations here today recognize the importance of consumers, SNE is unique in its emphasis on the factors that influence food practices and choices. As the food system has become increasingly complex, the introduction of new methods of food production, processing and preparation has increased the level of consumer confusion. Health, nutrition and food safety are important to them, but they want and need reliable information. Nutrition education professionals are a vital link between the developers of technology in agriculture, nutrition and food processing and the consumers whose perceptions and knowledge are essential in determining the success or failure of new products and processes.

To improve the nutritional health of a population, not only is it important to understand agriculture, food and nutrition science, but it is critical to understand the social, economic, psychological and environmental factors that shape food choices. This is an area of research in which SNE members excel.

The changing demographics of today's society, the variety of cultures, languages and ethnicities, and the changing food supply challenges our understanding of appropriate approaches to meet the food and nutritional needs of consumers in the United States and throughout the world. Currently, these factors are not well understood. Thus, USDA must play a lead role in supporting research in this area.

Along with increasing knowledge about factors shaping consumer behavior, we need research to understand how to change dietary behaviors. SNE members have been leaders in researching factors that influence dietary change and in developing and using models and theories as frameworks for intervention and investigation. We need additional research to develop more specialized models for

effective education of under served groups, evaluation of targeted communication methods, and development of innovative educational approaches. A thorough understanding of how people change their food habits and food preparation practices is critical to shaping educational and policy interventions to improve dietary behaviors.

USDA/CSREES has supported nutrition education research in funding cooperative extension-based education and the national research initiative (NRI). Cooperative extension funds are designated for education, but additional funding for research is rarely available. The NRI does cite research in obstacles to healthy eating and development of recommendations to improve nutritional status in its seven priorities. However, most research grants fund the five other priorities. Of the 24 human nutrition projects funded in FY 98, only two are related to nutrition education research.

SNE urges CSREES to increase funding for research initiatives to identify obstacles to healthy eating and developing recommendations to improve nutritional status. Improvements in food and nutrition spawned by food, nutrition and agriculture scientists will not be realized without complementary support for consumer-focused research.

Finally, SNE urges USDA/CSREES to support interdisciplinary research which brings together nutrition education researchers with their counterparts in food, nutrition and agriculture sciences. By working together on research objectives, we can better understand the needs and wants of consumers and meet the ultimate objective of an acceptable, safe, nutritious food supply for all.

Thank you for the opportunity to comment on this important research program.

University of California, Davis

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and  
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A new multi-discipline research effort that focuses on the use of agriculture to improve human nutrition should be developed and funded as a part of the USDA National Research Initiative competitive grant program.

The purpose of this research initiative would be to fund projects that utilize the multi-discipline expertise among nutrition, plant and food science to improve nutritional status through agriculture. There are several emerging issues that make this initiative timely and urgent. These issues include: The emerging interest in the international community that agriculture can be a sustainable alternative to supplementation or fortification programs for improving nutritional status. Many of these countries are currently relying on supplement or fortification programs to address severe undernutrition problems. These programs are costly and the cost is recurring. At a recent workshop of the CGIAR system, agricultural systems were identified as having substantial cost-benefit advantages for improving nutritional status. Likewise agricultural strategies for improving nutritional status have the potential for

long term sustainability. The impact of this research effort is likely to be most dramatic in developing countries; however, the value to developed nations and to low income segments of all countries will be highly significant.

Plant scientists have recognized the potential to target nutritional genomics in developing new varieties of crops (Science July, 1999). These efforts may be nonproductive if questions such as bioavailability, metabolism, upper limits of safety, and consumer acceptance are not addressed. Thus the multi-discipline approach is essential to fully realize the promise of nutritional genomics.

Nutritional genomics represents one strategy for improving nutritional status through agriculture. The processing of foods is another opportunity for improving nutritional content and bioavailability and thus nutritional status of the population. Research to explore innovative processing technology that will enhance both the safety of food and nutritional status is needed to encourage this approach.

The interest in phytochemicals, as bioactive compounds that might prevent chronic disease and promote health, has suggested mechanisms by which diets high in plant foods are protective against chronic disease. Substantial research is needed to define the role of these compounds in human nutrition and their bioavailability and metabolic effects.

The knowledge generated by nutritionists on the effects of compounds in plant foods on health is needed by agriculture to understand how to improve the nutritional quality of the food supply in their breeding and crop development programs.

The demographics of our population indicate that without a concerted effort to focus on prevention of chronic disease, the health care burden of these costs will escalate as the proportion of the population that is over 65 years continues to grow. We know that many of these diseases of aging have nutritional components. The multi-discipline efforts would allow us to design food-based interventions that can promote healthy, productive lifestyles throughout the life span.

In developing this area within the NRI, several principles are critically important:

The research projects must be multi-discipline in structure and focus. Nutrition, food and plant sciences each have high priority research objectives; the proposed research initiative represents an area in which these disciplines must work together so that developments in the plant or food sciences will have relevance for human nutrition and vice versa.

The review process for grants in this area must respect the multi-discipline nature of the research.

The hypotheses and/or questions proposed by the research project should encompass a multi-discipline approach that will address these issues.

## **Strengthen Global Competitiveness**

### **American Veterinary Medical Association and the Association of American Veterinary Medical Colleges**

Christopher Chase, D.V.M., Ph.D.

Representing the

American Veterinary Medical Association

and the

Association of American Veterinary Medical Colleges

#### **Strengthening Global Competitiveness of U.S.A. Animal Agriculture**

- C Deliver critical science, service and support for animal health needs in the USA
- C Enhance trade access for livestock commodities
- C Improve on-farm production through disease prevention
- C Reduce risks to the public from microbiological threats from animals
- C Enhance technology transfer to the producers

WTO Sanitary and Phytosanitary agreement requires that countries' health and consumer laws be based on science... we need to support science-based transparent trade policies and ensure that scientific measures govern international trade in animals and animal products

Food and Agriculture Organization (FAO) recognizes the need for a global Food Animal Residue Avoidance Databank (gFARAD) as a means to enhance the transparency of the SPS and to ensure a safe animal-derived food product on the international market

- C improve our monitoring and surveillance systems to identify new and re-emerging diseases
- C develop diagnostic tests for agent detection
- C develop vaccines and new drugs for disease prevention and resolution
- C expand training programs for infectious disease specialists
- C develop management systems, breeding programs, and immunological interventions that will enhance neonatal protection against diseases, prevent deaths, reduce production loss, and make livestock systems more economical and sustainable
- C identify critical control points in order to design strategies to assure safe, wholesome food of high quality, and to facilitate trade of livestock products between nations
- C improve management conditions that provide reduced inputs and higher quality outputs by use of database program analysis
- C provide funding support for emergency situations where new diseases threaten the safety of food, the economy of production, or the export of product

Research on the economic impact to the livestock producer of trade policy needs to be done to demonstrate the effectiveness of NAFTA and other trade treaties. The blockade against Canadian beef that occurred in the North Central States (SD, ND, MN, NE and MT) was the direct result of the lack of both sound research and information distribution to provide a scientific basis. Instead it was a highly charged issue with decisions being based on emotion and political rhetoric.

## **Ensure Environmental Quality**

### **American Society of Animal Science**

Comments by Don Beermann, President American Society of Animal Science

Environmental issues affecting animal production enterprises include surface water contamination by runoff, accumulation of nutrients in soil or ground water, and odor or fly nuisances. Nitrogen and phosphorus compounds and bacteria are of primary concern in intensive production systems. Efforts to protect water quality and avoid nuisance complaints led to state regulations or local ordinances with greater land requirements for distribution of animal waste, increased setbacks for animal units from roads and residential properties and increased monitoring of enterprise impact on the environment. None of these legislated requirements address the important approaches of source control or define management practices that influence the source. A “systems” research approach is needed to determine best management practices to improve efficiency of resource use, minimize environmental impact and assure sustainability of intensive and extensive animal production enterprises. “Systems” research involves more than just one or two segments of production. Systems research compares management strategies or methods, and systems research usually requires that investigations be conducted over several generation or cycles of production to allow accurate measurement of responses. Some systems may reduce animal density and reduce the problems of waste and odor. Support for “systems” research is not readily available from industry or traditional granting agencies to allow multi-disciplinary teams of animal scientists, agronomists, engineers, entomologists, economists and social scientists to conduct this important research. The NRI Agricultural Systems program is inadequately funded to meet the need..

In intensive animal enterprises reduced accumulation of nutrients can be achieved by improving composition of the diet to more closely match nutrient requirements for growth or lactation and by improving the availability of dietary nutrients. New technologies such as modeling nutrient requirements, use of enzyme feed additives, and modified nutrient composition of diet components are now available to help achieve a total or whole-farm nutrient balance for livestock enterprises. Odors associated with animal production units can also be influenced by management strategies or technologies. These include controlling composition of the diet, stocking density, air temperature and humidity, building ventilation rate, feeding method and type of waste management system. We do not know the relative impact of these critical factors or control points on nutrient flow, odors or economic benefit to the system, however.

Recent research on extensive (rangeland) management systems provides an example where great potential exists for improving profitability and resource sustainability of beef production enterprises. Impacts on the range and meadow ecosystems, on sustainable stocking rates and on long-term reproductive performance of the cows are being evaluated in the fragile, 13 million acre Sandhills area of Nebraska. Matching calving date to nutrient changes in upland range and meadow forages and using dormant-season or extended winter grazing reduced annual fed forage by 1690 kg per cow and reduced cost by approximately \$50.00. Additional research is needed to compare different management schemes for backgrounding weaned calves and for summer grazing of yearlings on different combinations of upland and meadow range to reduce feedlot residence time and nutrient accumulation in the feedlot. These multidisciplinary investigations should also study effects of cattle grazing systems on sustainable cattle stocking rates, upland and meadow range plant diversity, herd health and reproductive performance, pest management and natural resource inventories in the Sandhills ecosystem. Impact on well-being or benefits to the community are also important.

The “systems” research approach to assuring environmental quality in both intensive and extensive livestock production systems should be provided a high priority. Additional or new support should be allocated to “systems” livestock production research.

## CATFISH FARMERS OF AMERICA

Catfish Farmers of America, (CFA) is the trade association that represents the interests of the farm-raised catfish industry. Founded in 1968 and with membership from thirty-one states; CFA is recognized as the nations strongest aquaculture association. Catfish farming is the dominant component of U.S. aquaculture - representing 72% of the total production volume and 55% of the product value.

Aquaculture is poised to become a major growth industry in the 21st century. The U.S. imports nearly half of the its fisheries supplies. This results in a fisheries trade deficit of \$4 to \$7 billion annually, the largest trade deficit for any food or agricultural commodity.

USDA Should Expand its Integrated Aquaculture Research and Extension Programs in Three Critical Areas including: Aquaculture genetics, health management and environmental sustainability of aquaculture systems.

1. There has been only limited genetic improvement of aquaculture stocks so there are major opportunities in traditional animal breeding and in genetics to improve the growth, efficiency, health status, and product form and quality of commercially valuable aquaculture species. Genetic improvement of aquaculture stocks will require enhanced efforts in research related to selective breeding; genome mapping; and identification and genetic enhancement of economically important traits.
2. Losses to diseases constitute one of the major economic impacts of U.S. aquaculture today. Over 65 diseases affect cultivated U.S. aquaculture species, and devastating emerging diseases of catfish, salmonids, marine shrimp and other species threaten the future of the industry. The industry’s ability to control diseases is severely constrained by inadequate knowledge of many diseases and limited prevention or treatment options, including vaccines, therapeutics, and

management techniques. Improved management of aquatic animal health will require expanded efforts in understanding pathogens and mechanisms of disease transmission; improved technologies to detect pathogens before disease outbreaks occur; and development and approval of new vaccines and animal drugs to prevent and treat diseases.

3. There is increasing concern about the potential impact of agriculture on the nation's water quality and the possible contribution of agriculture-based nutrients to harmful algal blooms. As U.S. aquaculture continues to expand it must be sustainable and environmentally compatible, particularly with regard to protection and conservation of the nation's water resources. There is significant need for expanded efforts to improve efficiency in the utilization and management of surface and ground water supplies in aquaculture systems; to develop more efficient and cost-effective waste management processes and technologies in aquaculture; and to develop economically viable users of aquaculture production and processing byproducts.

## **Moderators' Summaries of Sessions**

### **PROMOTE ANIMAL WELL-BEING**

#### **Stakeholder Workshop 12/7/99**

- # Develop better scientific measures to assess animal well-being (physiological and psychological criteria), and determine the impact of current and alternative production systems on animal well-being, food safety, food quality, and animal productivity.
- # Explore social and political issues in animal production, and use an integrated, multi-disciplinary approach in research and education for the study and proper assessment of animal well-being.
- # Study animal adaptiveness through genetic and environmental manipulations, and evaluate the effects of genetic modifications on the well-being animals, especially GMO's produced through genetic engineering.
- # Develop better measures of well-being to assess the stress, pain, handling, and health of animals, and evaluate stress and distress in large intensive production systems and alternative production systems, including pasture-based systems.
- # Conduct practical animal handling studies at farm level, and establish a CSREES initiative for "Farm Animal Worker Training", including development of training materials related to Ag Guide, which in the future may serve as a origin point for the ultimate development of HACCP-based, on-farm training modules.
- # A limited number of ethologists are conducting research on farm species. Enhance research activities in ethology by establishing CSREES graduate fellowships on farm animal behavior, by encouraging non-agricultural behaviorists to work with farm animals, and by forming partnerships and collaborations among scientists (with "virtual sharing" of research information).
- # Develop university centers for studying animal welfare with a critical mass of interested scientists for integrated multidisciplinary targeted research/outreach activities to address critical public issues and foster partnering with ARS.

- # The current research investment should be increased, but be more focused and targeted with greater accessibility to research results. The following areas were identified for special study:
  - C use and non-use of anti-microbials on animal well-being,
  - C evaluation of breeding programs are needed for alternative production systems, especially small and mid-sized producers,
  - C evaluations of housing facilities designs (for all farm species), and
  - C maintain an awareness of developments in animal law and the movement of welfare issues into the judicial system.
- # Continue NRICG competitive funding for targeted studies in the animal well-being area. Encourage Multi-State Projects for national cooperative efforts focusing on animal well-being with integrated multi-disciplinary studies addressing public issues and concerns.

## Synthesis of Discussion Points from session 2: “Protect Animal Health” (Dec. 7, 1999)

Foreign AND Domestic Animal Diseases - infectious and non-infectious  
> 50 diseases identified as high priority (incl. major commodity species)

### Critical TRIAD

1. Biosecurity
  2. Diagnostics / Surveillance
  3. Vaccines
- +/- Management Options to decrease disease (e.g., alternative facilities )  
---> Smaller operations and Biosecurity

### Genomics will be increasingly important

- Animal genomics: breeding for genetic resistance to diseases
- Microbial genomics: for improved diagnostics, vaccines

### Prioritization List of Disease ?

- Form with broad input and make national assessment

\*\*\* Pursue Joint Stakeholder Meeting with ARS (other agencies, APHIS, etc.) \*\*\*

----> increased communication among all critical players at the same time <-----

Need to balance Genetic Diversity vs. Need for Market Uniformity

### Urgent Need to Study:

1. Alternative Disease Treatments ( nutraceuticals, probiotics )
2. Nutrition and Immunity
3. Interactions between Livestock and Wildlife of increasing importance  
( Brucella, TB, CWD, Lepto, Heartwater, Texas Cattle Fever )
4. Antimicrobial resistance



5. Management of Animal Manure / Disease Control
6. Long term study of disease organisms causing Mastitis  
(how fund, link food safety)

#### Consumer Confidence and Food Safety

Zoonotic Diseases ? John's and its implication for human health

### **Stakeholders' Workshop — Discussion Points for Human Nutrition:**

- C Obesity in U.S. is increasing despite relative decrease in fat consumption — do high carbohydrate diets cause an increase in glycemic index and if so, does this impact weight gain?
- C Need Food Guide Pyramid to make distinction among more desirable and less desirable fruits, vegetables, and grain products
- C Enhance local availability of fresh fruits and vegetables, eggs, dairy products, meat (people more likely to increase intake of fruits and vegetables if they are fresher, taste better, perhaps less expensive)
- C Increase shelf life to improve quality of food products, therefore increasing consumer acceptance (especially true for dairy products)
- C Need more consumer-focused research — what motivates people to change food habits, and what constitute obstacles to healthy eating
- C Need research on effect of overall dietary pattern on health (e.g., clinical trial of Food Guide Pyramid-based diet similar to what was done with DASH diet).
- C Need focus on providing positive guidance, less on negative (e.g., tell people what to eat rather than what not to eat).
- C Need information on biomarkers for nutritional status relative to impact on health
- C What is satiety value of meat and some fat in diet — do low fat diets lead to overeating?
- C Need data on variability in basal energy requirements in humans

- C      Need more interdisciplinary research
- C      Need to develop partnerships with NIH, others to stretch funding dollars

## **Session 5: Strengthen Global Competitiveness**

U.S. animal agricultural firms must be successful in the domestic market and the international market. Research is needed to improve the understanding of the diverse and changing needs and desires of customers in both markets, and to develop the products that will satisfy them. World-wide consumer demand includes a mixture of tastes and preferences; desires for convenience, nutrition and food safety; plus knowledge that animals are treated humanly and the environment is not harmed. Furthermore, consumer demand in a specific country or region changes over time as a result of changes in income, lifestyle, age, family structure, and ethnicity.

New and emerging markets need to be discovered and developed, including markets for “natural” products and products from “sustainable” practices. Effective marketing affects profitability; hence it can be a substitute for efficiency in some situations.

The world demand for animal products is increasing rapidly in response to increasing incomes and population. This increasing demand is on a collision course with the world’s ability to produce enough animal feed and to protect the environment. Research and education are the means of finding and implementing alternative means of avoiding the collision.

A systems approach to research is needed. The system includes animal production (e.g. feeds, genetics, animal health, and facilities), processing, markets, and environment. Research is needed to find efficient, competitive systems that simultaneously satisfy many objectives.

Attention needs to be given to systems approaches for discovering more sustainable practices and “natural” products that are competitive. These are likely to be low-input, forage-based systems primarily used by small farmers.

Efficiency is an important ingredient in competitiveness. Yet efficiency can put a large number of producers out of business if larger-sized operations are the main source of efficiency. Alternatives means of achieving efficiency and profitability need to be explored.

Increasing trade requires greater capacity for controlling disease. Research is needed to provide adequate surveillance techniques, diagnostic tests, vaccines and other medications, and training to protect U.S. production and to satisfy the food safety demands of our domestic and international customers.

Small farmers need to be able to gain access to markets. Use of cooperatives, alliances, and other methods need to be explored; alternatives for obtaining access to good market information need to be developed. Education about markets and marketing is needed.

There is an export market for new, sustainable technologies, that could be just as important the export of animal products.

Increased packer/processor concentration ratios, vertical coordination and integration, and market power are of concern to many producers, consumers and policy makers. At the same time, these

changes have provided a high degree of efficiency that may have benefits to producers and consumers. Research is needed to determine the causes and consequences of structural changes, develop strategies for profitable family farms, and develop and evaluate policy alternatives.

Large production-processing operations are expected to supply most of the nation's animal products. They will satisfy consumers with an abundant and varied supply of reasonably-priced, highly-quality products. While CSREES-sponsored research and education programs of importance to this system will need to continue, more attention should be given to alternative production-distribution systems.

Large production-processing systems can have negative impacts on the environment and local communities. Research is needed to understand and measure the impacts, develop and evaluate alternative technologies and policies to mitigate the impacts, including policies that would make firms more responsible for the negative impacts that they create.

Trade policy issues are of growing importance because of increasing globalization of markets for livestock products. Attention needs to be given to the impact of recent trade agreements, and evaluation of alternatives for new agreements.

The WTO agreement requires countries to use science-based trade restrictions to protect their consumers. The US needs a strong research base to justify protection for its own consumers and to challenge the protections of other countries. Recent issues include hormones, antibiotics, drug residues and BSE.

Is our science on animal industries focused properly on the needs of society? Research priorities are determined by public and private funding streams that conform to the views of their sponsors, and research projects are defined by the perceptions and values of scientists, including their need to publish. As a result, the issues and concerns of some segments of society are under-represented. These issues and concerns need to be identified and included in the public research portfolio.

## ENSURE ENVIRONMENTAL QUALITY

### RESEARCH ISSUES:

- C Surface and ground water, and soil quality; nutrients (P&N) transport, transformations, and overall balance (farm to watershed scale); endocrine disruptors and heavy metals
- C Odors, gases and particulates; inside and outside livestock buildings
- C Diet manipulation to control nutrient output
- C Animal manure effects on ecosystems ( plants and wildlife), can the systems co-habit the same area
- C Grazing effects on water quality
- C Pathogen fate and transport
- C Human health and safety in animal production practices
- C Alternative treatment technologies
- C Use animal behavior patterns to develop better manure management systems
- C Liquid vs. solid waste management systems

### SOCIAL/POLICY/SYSTEM ISSUES:

- C Work with social sciences to positively impact public understanding of animal agriculture
- C Redistribution and structure of the dairy, swine, beef and poultry industry affects what the LGU system should be doing
- C Multi-disciplinary and systems approach to research
- C Large concentrated facilities have high potential for environmental problems
- C Economic viability is essential to animal production, use economics in policy development and management techniques
- C National Initiative on animal byproduct (manure) system
- C National water quality data base (it should be better than what exists)
- C Compatibility of rural communities and animal production
- C Stop using the word “waste”, it is a resource and not a waste
- C Agriculture must communicate with the public and private sector about education, extension and research techniques for managing animal waste
- C TRUST, the public does not have the level of trust in agricultural science that is used to have. Agricultural Science should be out front in raising environmental concerns and not wait and have to be in a reactive mode.
- C Integrate cropping and livestock systems
- C Cost share programs to encourage environmental practices
- C Reduce pesticide use on livestock
- C GMO (genetically modified) feeds and their fate in meat, milk and the environment